

REMARKS

Claims 1-22 are currently pending. Claims 21 and 22 have been added herein. Support for new claims is based on original claims 1 and 11 and is located in the specification at lines 13-15 on page 7, lines 5-7 on page 8 and in Fig. 1F-1H.

Applicants' Response to Claim Rejections under 35 U.S.C. §102:

Claims 1-2, 4-6, 9-12, 14 and 17-20 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,579,808 (**Cho et al.**). Applicants respectfully traverse on the basis that not all the limitations of the claimed invention are set forth in **Cho et al.** Specifically, the limitation of claims 1, 10, 17 and 19 require etching a surface layer of sidewalls and a top wall of the resist pattern by plasma of a mixture gas of a first gas and an SO₂ gas, the first gas comprising at least one gas selected from the group consisting of He, Ne, Ar, Xe, Kr, CO, CO₂ and N₂. This limitation is not disclosed either expressly or inherently in the cited reference.

The Office Action maintains that **Cho** discloses dry etching the sidewalls and top portions of the photoresist pattern using SO₂ and He as the etch gas mixture. Page 2, paragraph 2 of the Office Action. However, **Cho et al.** is narrowing the etch dimension by employing SO₂/He whereas the present invention increases the etching hole.

Cho et al. teaches that the use of SO₂/He to etch the anti-reflective coating layer 206 results in the formation of a polymer as side walls 210. Col. 3, lines 62-67. This polymer side wall narrows the intended contact hole side from the original dimensions of the photoresist a2 (ex: 0.17 μm) (col. 3, lines 49-53) to the distance between the polymer side walls 210, b2 (ex:

0.14 μm) (col. 4, lines 1-4). **Cho et al.** teaches that the primary advantage of the SO_2/He mixture is this polymer formation to narrow the contact hole dimensions.

Specifically, **Cho et al.** states, in the paragraph beginning at line 62, column 3, “In the first dry etch process 220, the SO_2 gas has a reactivity lower than that of the O_2 gas. The SO_2 gas has no lateral etch properties, and thereby generates polymer due to reaction with etch floating particles. The polymer is attached to the exposed side of the remaining Anti-Reflective Coating layer to form a polymer sidewall 210, as shown.” **Cho et al.** does not state that the sidewalls of the resist pattern 208 are etched. Forming the polymer sidewall 210 is inconsistent with etching the side of the Anti-Reflective Coating layer 207 shown in Fig.3B.

Furthermore, **Cho et al.** states, in the paragraph beginning at line 15, column 4, “As a result of the second dry etch process 222, the contact hole 230 has a dimension equal to b_2 **smaller** than that of the dimension of a_2 .” If the side of resist pattern 208 were etched during etching the Anti-Reflective Coating layer 207, the contact hole 230 would have been made **larger**. Applicants respectfully submit that it is contrary to the purpose of **Cho et al.**’s invention to etch the side of the resist pattern 208. Wherefore, **Cho et al.** does not teach, either expressly or inherently, etching a surface layer of sidewalls by plasma of a mixture gas of a first gas and a second gas.

Applicants’ Response to Claim Rejections under 35 U.S.C. § 103

Claims 3, 7-8, 13 and 15 stand rejected under 35 U.S.C. 103(a) as being unpatentable over **Cho et al.** in view of **Ohkuno et al.** (US 6,187,688). As these claims depend from

independent claim 1 or 10 which are addressed above, applicants respectfully submit that the rejection of the claims is addressed by nature of their dependency.

Additionally, applicants submit that **Ohkuni et al.** does not teach or suggest the limitation of claims 7, 8, and 15-16 directed to a step of increasing a ratio of a flow rate of a flow rate of the SO₂ gas to a flow rate of the O₂ gas during the etching. In the method shown in Table 13 column 15 of **Ohkuni et al.**, the flow rates of SO₂ and O₂ are constant during etching the ARC. After etching the ARC, the S component is removed using N₂ plasma. Namely, a ratio of the flow rate of the SO₂ gas to a flow rate of the O₂ gas during the etching is constant. Wherefore, **Ohkuni et al.** does not disclose the step of increasing a ratio of a flow rate of the SO₂ gas to a flow rate of the O₂ gas during the etching.

In regard to Claims 3 and 13, these claims are characterized by that the flow rate of the first gas, which is the gas other than SO₂ gas, is equal to or larger than 40 % of flow rate of the mixture gas. Applicants respectfully submit that neither **Cho et al.**, nor **Ohkuni et al.** teach or suggest this limitation, nor would the combination result in this required step. **Cho et al.** do not disclose a relationship between the flow rate of the SO₂ and the flow rate of the He, and the mixture gas shown in Table 13 of **Ohkuni et al.** comprises O₂ but does not comprise the first gas.

Claims 3 and 13 have the advantageous effect that resist pattern deformation and pattern collapse are prevented. See page 9, 1st paragraph of the present specification. Applicants respectfully submit that there is no teaching in either reference to adjust the flow rate as required by the claims, nor is there a teaching or suggestion which would lead the skilled artisan to adjust the flow rate accordingly.

Application No. 10/692,722
Attorney Docket No. 032045

Amendment under 37 C.F.R. §1.111
Amendment filed: December 27, 2005

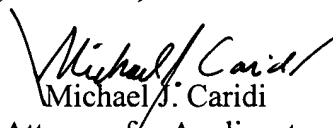
In view of the accompanying remarks, Applicants submit that that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP


Michael J. Caridi
Attorney for Applicants
Registration No. 56,171
Telephone: (202) 822-1100
Facsimile: (202) 822-1111

MJC/mra